



Autonomous Mobile Robots

Roland Siegwart, Illah R. Nourbakhsh



Autonomous Mobile Robots:

Autonomous Mobile Robots: Control, planning, and architecture S. Sitharama Iyengar,Alberto Elfes,1991

Introduction to Autonomous Mobile Robots, second edition Roland Siegwart,Illah Reza Nourbakhsh, Davide

Scaramuzza,2011-02-18 The second edition of a comprehensive introduction to all aspects of mobile robotics from algorithms to mechanisms Mobile robots range from the Mars Pathfinder mission s teleoperated Sojourner to the cleaning robots in the Paris Metro This text offers students and other interested readers an introduction to the fundamentals of mobile robotics spanning the mechanical motor sensory perceptual and cognitive layers the field comprises The text focuses on mobility itself offering an overview of the mechanisms that allow a mobile robot to move through a real world environment to perform its tasks including locomotion sensing localization and motion planning It synthesizes material from such fields as kinematics control theory signal analysis computer vision information theory artificial intelligence and probability theory The book presents the techniques and technology that enable mobility in a series of interacting modules Each chapter treats a different aspect of mobility as the book moves from low level to high level details It covers all aspects of mobile robotics including software and hardware design considerations related technologies and algorithmic techniques This second edition has been revised and updated throughout with 130 pages of new material on such topics as locomotion perception localization and planning and navigation Problem sets have been added at the end of each chapter Bringing together all aspects of mobile robotics into one volume Introduction to Autonomous Mobile Robots can serve as a textbook or a working tool for beginning practitioners Curriculum developed by Dr Robert King Colorado School of Mines and Dr James Conrad University of North Carolina Charlotte to accompany the National Instruments LabVIEW Robotics Starter Kit are available Included are 13 6 by Dr King and 7 by Dr Conrad laboratory exercises for using the LabVIEW Robotics Starter Kit to teach mobile robotics concepts Autonomous Mobile Robots Frank L. Lewis,Shuzhi Sam Ge,2018-10-03 It has long been the goal of engineers to develop tools that enhance our ability to do work increase our quality of life or perform tasks that are either beyond our ability too hazardous or too tedious to be left to human efforts Autonomous mobile robots are the culmination of decades of research and development and their potential is seemingly unlimited Roadmap to the Future Serving as the first comprehensive reference on this interdisciplinary technology Autonomous Mobile Robots Sensing Control Decision Making and Applications authoritatively addresses the theoretical technical and practical aspects of the field The book examines in detail the key components that form an autonomous mobile robot from sensors and sensor fusion to modeling and control map building and path planning and decision making and autonomy and to the final integration of these components for diversified applications Trusted Guidance A duo of accomplished experts leads a team of renowned international researchers and professionals who provide detailed technical reviews and the latest solutions to a variety of important problems They share hard won insight into the practical implementation and integration issues involved in developing autonomous and open

robotic systems along with in depth examples current and future applications and extensive illustrations For anyone involved in researching designing or deploying autonomous robotic systems *Autonomous Mobile Robots* is the perfect resource

Autonomous Mobile Robots Rahul Kala,2023-09-01 *Autonomous Mobile Robots Planning Navigation and Simulation* presents detailed coverage of the domain of robotics in motion planning and associated topics in navigation This book covers numerous base planning methods from diverse schools of learning including deliberative planning methods reactive planning methods task planning methods fusion of different methods and cognitive architectures It is a good resource for doing initial project work in robotics providing an overview methods and simulation software in one resource For more advanced readers it presents a variety of planning algorithms to choose from presenting the tradeoffs between the algorithms to ascertain a good choice Finally the book presents fusion mechanisms to design hybrid algorithms Presents intuitive and practical coverage of all sub problems of mobile robotics to enable easy comprehension of sophisticated modern day robots Covers a wide variety of motion planning algorithms giving a near exhaustive treatment of the domain with thought provoking comparisons between algorithms Dives into detailed discussions on robot operating systems and other simulators to get hands on knowledge without the need of in house robots

Autonomous Mobile Robots: Vehicles With Cognitive Control Alex Meystel,1991-03-29 This book explores a new rapidly developing area of robotics It describes the state of the art in intelligence control applied machine intelligence and research and initial stages of manufacturing autonomous mobile robots A complete account of the theoretical and experimental results obtained during the last two decades together with some generalizations on Autonomous Mobile Systems are included in this book

Dynamics for vision guided autonomous mobile robots Hartmut Neven,1997 *Autonomous Mobile Robots in Unknown Outdoor Environments* Xiaorui Zhu,Youngshik Kim,Mark A. Minor,Chunxin Qiu,2017-12-15 Mobile robots have been increasingly applied in many different scenarios such as space exploration and search and rescue where the robots are required to travel over uneven terrain while outdoors This book provides a new framework and the related algorithms for designing autonomous mobile robotic systems in such unknown outdoor environments

Designing Autonomous Mobile Robots John M. Holland,2004-01-24 *Designing Autonomous Mobile Robots* introduces the reader to the fundamental concepts of this complex field The author addresses all the pertinent topics of the electronic hardware and software of mobile robot design with particular emphasis on the more difficult problems of control navigation and sensor interfacing Covering topics such as advanced sensor fusion control systems for a wide array of application sensors and instrumentation and fuzzy logic applications this volume is essential reading for engineers undertaking robotics projects as well as undergraduate and graduate students studying robotic engineering artificial intelligence and cognitive science Its state of the art treatment of core concepts in mobile robotics helps and challenges readers in exploring new avenues in an exciting field Authored by a well known pioneer of mobile robotics Learn how to approach the design of and complex control system with confidence

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and Multi-Robot Systems Eugene Kagan, Nir Shvalb, Irad Ben-Gal, 2019-09-04 Offers a theoretical and practical guide to the communication and navigation of autonomous mobile robots and multi robot systems This book covers the methods and algorithms for the navigation motion planning and control of mobile robots acting individually and in groups It addresses methods of positioning in global and local coordinates systems off line and on line path planning sensing and sensors fusion algorithms of obstacle avoidance swarming techniques and cooperative behavior The book includes ready to use algorithms numerical examples and simulations which can be directly implemented in both simple and advanced mobile robots and is accompanied by a website hosting codes videos and PowerPoint slides Autonomous Mobile Robots and Multi Robot Systems Motion Planning Communication and Swarming consists of four main parts The first looks at the models and algorithms of navigation and motion planning in global coordinates systems with complete information about the robot s location and velocity The second part considers the motion of the robots in the potential field which is defined by the environmental states of the robot s expectations and knowledge The robot s motion in the unknown environments and the corresponding tasks of environment mapping using sensed information is covered in the third part The fourth part deals with the multi robot systems and swarm dynamics in two and three dimensions Provides a self contained theoretical guide to understanding mobile robot control and navigation Features implementable algorithms numerical examples and simulations Includes coverage of models of motion in global and local coordinates systems with and without direct communication between the robots Supplemented by a companion website offering codes videos and PowerPoint slides Autonomous Mobile Robots and Multi Robot Systems Motion Planning Communication and Swarming is an excellent tool for researchers lecturers senior undergraduate and graduate students and engineers dealing with mobile robots and related issues

Introduction to Autonomous Mobile Robots Roland Siegwart, Illah R. Nourbakhsh, 2004 *Autonomous Robots* George A. Bekey, 2005 An introduction to the science and practice of autonomous robots that reviews over 300 current systems and examines the underlying technology

Intelligent Moving Cities: Technological Leap and Social Integration of Autonomous Mobile Robots Minje Choi, Seungjae Lee, 2025-08-25 The book Intelligence Moving Cities methodically unveils the multifaceted impacts of autonomous mobile robots on urban environments Through seven insightful chapters readers are taken on a journey from the historical developments in robotics to cutting edge applications that promise a more livable safe and efficient cityscape From navigation systems and design tailored specifically for urban settings to their integration into daily activities this book provides a comprehensive look at the technological advancements that are transforming our public spaces Each chapter delves deep into critical aspects of urban autonomous robotics the societal and technological drivers the evolution of robotics core technologies of navigation and mobility design and scalability of urban use robots and their diverse applications ranging from public safety to personal mobility and logistics Furthermore it addresses the broader implications of deploying these technologies in urban settings including urban planning pedestrian safety and the overall enhancement of

city life Targeted at technologists urban planners policymakers and academics Intelligence Moving Cities is not merely a technical recount but a profound statement on the intersection of technology urban planning and social integration It offers practical examples case studies and forward looking analyses making it an indispensable resource for anyone committed to the future of urban development Explore the transformative potential of autonomous robotics in creating more accessible efficient and people oriented urban environments with Intelligence Moving Cities Join the movement toward revolutionizing city life ensuring a sustainable inclusive and thriving future for urban landscapes

Localization and Mapping of Autonomous Mobile Robots Junzhi Yu,Zhiqiang Cao,Peiyu Guan,Chengpeng Wang,2025-10-31 Localization and mapping play a critical role in the autonomous task execution of mobile robots This book covers the theoretical and technological aspects of robot localization and mapping including visual localization and mapping visual relocalization LiDAR localization and mapping and place recognition It provides the theoretical foundations of robot localization and mapping It employs both traditional methods such as geometry based visual localization and state of the art deep learning techniques that improve robot perception The authors also address LiDAR based localization exploring techniques to improve both efficiency and accuracy when processing dense point clouds Key topics include visual localization using deep features integration of visual solutions under ROS based software architecture and distribution based LiDAR localization This book will be of great interest to students and professionals in the fields of robotics and artificial intelligence It will also be an excellent reference for engineers and technicians involved in the development of robot localization

Wheeled Mobile Robotics Gregor Klancar,Andrej Zdesar,Saso Blazic,Igor Skrjanc,2017-02-02 Wheeled Mobile Robotics From Fundamentals Towards Autonomous Systems covers the main topics from the wide area of mobile robotics explaining all applied theory and application The book gives the reader a good foundation enabling them to continue to more advanced topics Several examples are included for better understanding many of them accompanied by short MATLAB script code making it easy to reuse in practical work The book includes several examples of discussed methods and projects for wheeled mobile robots and some advanced methods for their control and localization It is an ideal resource for those seeking an understanding of robotics mechanics and control and for engineers and researchers in industrial and other specialized research institutions in the field of wheeled mobile robotics Beginners with basic math knowledge will benefit from the examples and engineers with an understanding of basic system theory and control will find it easy to follow the more demanding fundamental parts and advanced methods explained Offers comprehensive coverage of the essentials of the field that are suitable for both academics and practitioners Includes several examples of the application of algorithms in simulations and real laboratory projects Presents foundation in mobile robotics theory before continuing with more advanced topics Self sufficient to beginner readers covering all important topics in the mobile robotics field Contains specific topics on modeling control sensing path planning localization design architectures and multi agent systems

Build Autonomous Mobile Robot

from Scratch using ROS Rajesh Subramanian, 2023-10-29 Start from scratch and build a variety of features for autonomous mobile robots both in simulation and hardware This book will show you how to simulate an autonomous mobile robot using ROS and then develop its hardware implementation You'll start by gaining an understanding of the basic theoretical concepts underlying the development of autonomous robots including history mathematics electronics mechanical aspects 3D modelling 3D printing Linux and programming In subsequent chapters you will learn how to describe kinematics simulate and visualize the robot how to interface Arduino with ROS tele operate the robot perform mapping autonomous navigation add additional sensors sensor fusion laser scan matching web interface and more Not only will you learn theoretical aspects you'll also review the hardware realization of mobile robots Projects start with a very basic two wheeled mobile robot and progress to complex features such as mapping navigation sensor fusion autodocking and web interface Upon completing this book you'll have incorporated important robot algorithms including SLAM Path Finding Localization and Kalman Filters and you will be ready to start designing and building your own autonomous robots What You Will Learn Design and build your customized physical robot with autonomous navigation capability Create a map of your house using the robot's lidar scanner Command the robot to go to any accessible location on the map Interact with the robot using a mobile app joystick keyboard push button or remote computer Monitor robot updates via LCD a mobile app sound and status LEDs Automate delivery of small payloads and return to home base Utilize autodocking to home base for battery charging Leverage sensor fusion to improve accuracy Interface with the robot via the Web to monitor and control it remotely Who This Book Is For Complete beginners who want to build customized robots from scratch No experience is expected although basic programming knowledge could be handy

Information Processing in Autonomous Mobile Robots Günther Schmidt, 1991 This volume is a collection of 22 papers presented at the International Workshop on Information Processing in Autonomous Mobile Robots held in Munich Germany in March 1991 Autonomous mobile robot technologies are generating significant interest because of their potential capabilities for future applications on the plant floor as well as in the service industry Autonomous robots may navigate around factories and laboratories hospitals office buildings airports or similar public and semipublic places They may deliver equipment collect garbage and perform other such tasks One of the major challenges for the field of autonomous mobile robot research is to develop robust and real time systems for perception and understanding of complicated real environments as well as for intelligent decision making with respect to proper actions This Workshop was set up to stimulate discussion and the exchange of new ideas on various aspects of autonomous mobile robot methodologies and applications The main focal points of the Workshop program were sensing and perception navigation and control knowledge bases and computer architectures as well as various applications The papers are prepared by leading experts in these areas from Europe Japan the United States and by researchers involved in the interdisciplinary research project on Information Processing in Autonomous Mobile Robots Sonderforschungsbereich 331 at the Technische Universität München

Autonomous Mobile Robots: Perception, mapping, and navigation S. Sitharama Iyengar,Alberto Elfes,1991-01-01

Distributed Computing by Oblivious Mobile Robots Paola Flocchini,Giuseppe Prencipe,Nicola Santoro,2012-08-01 The study of what can be computed by a team of autonomous mobile robots originally started in robotics and AI has become increasingly popular in theoretical computer science especially in distributed computing where it is now an integral part of the investigations on computability by mobile entities The robots are identical computational entities located and able to move in a spatial universe they operate without explicit communication and are usually unable to remember the past they are extremely simple with limited resources and individually quite weak However collectively the robots are capable of performing complex tasks and form a system with desirable fault tolerant and self stabilizing properties The research has been concerned with the computational aspects of such systems In particular the focus has been on the minimal capabilities that the robots should have in order to solve a problem This book focuses on the recent algorithmic results in the field of distributed computing by oblivious mobile robots unable to remember the past After introducing the computational model with its nuances we focus on basic coordination problems pattern formation gathering scattering leader election as well as on dynamic tasks such as flocking For each of these problems we provide a snapshot of the state of the art reviewing the existing algorithmic results In doing so we outline solution techniques and we analyze the impact of the different assumptions on the robots computability power Table of Contents Introduction Computational Models Gathering and Convergence Pattern Formation Scatterings and Coverings Flocking Other Directions

Feature-Based Localization in Sonar-Equipped Autonomous Mobile Robots Through Hough Transform and Unsupervised Learning Network Jonathan Scott Glennon,Naval Postgraduate School (U.S.),1998-06-01 As we approach the new millennium robots are playing an increasingly important role in our everyday lives Robotics has evolved in industrial and military applications and unmanned space exploration promises the continued development of ever more complex robots Over the past few decades research has focused on the development of autonomous mobile robots robots that can move about without human supervision This brings with it several problems however specifically the problem of localization How can the robot determine its own position and orientation relative to the environment around it Various methods of localization in mobile robots have been explored Most of these methods however assume some a priori knowledge of the environment or that the robot will have access to navigation beacons or Global Positioning Satellites In this thesis the foundations for feature based localization are explored An algorithm involving the Rough transform of range data and a neural network is developed which enables the robot to find an unspecified number of wall like features in its vicinity and determine the range and orientation of these walls relative to itself Computation times are shown to be quite reasonable and the algorithm is applied in both simulated and real world indoor environments

Autonomous mobile robots. 1. Perception, mapping, and navigation Sundararaja S. Iyengar,1991

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